

REMARKS

This Amendment is filed in response to the FINAL Office Action dated June 27, 2008, and with the request for continued Examination (RCE) filed on even date herewith. All rejections and objections are respectfully traversed.

Claims 1 – 15, 19 – 20, and 23 – 42 are pending in this case.

Claims 1, 9, 19 – 20, 23, 31, and 39 – 42 have been amended.

Request for Interview

The Applicant respectfully requests a telephonic interview with the Examiner after the Examiner has had an opportunity to consider this Amendment, but before the issuance of the next Office Action. The Applicant may be reached at 617-951-2500.

Claim Objections

At paragraphs 1 and 2 of the Office Action, claim 41 was objected to. The Examiner asserted that there was insufficient antecedent basis for the limitation in the claim. Applicant respectfully submits that the amendment to the claim satisfies the objection.

Claim Rejection – 35 USC §102

At paragraphs 3 – 5 of the Office Action claims 23, 31, and 39 were rejected under 35 USC §102(e) as being anticipated by Cameron et al., U.S. Patent No. 7,165,156, issued on January 16, 2007 (hereinafter “Cameron”).

Applicant’s claimed invention, as set forth by independent claim 23, comprises in part:

23. A method for operating a data storage system, comprising:
creating a writable virtual disk (vdisk) at a selected time, the writable vdisk referencing changes in data stored in the data storage system after the writable vdisk was created, the writable vdisk having a plurality of holes where each hole instructs the storage system to examine a corresponding virtual block number pointers in a backing store;
maintaining the backing store, the backing store referencing the data stored in the data storage system which has not been changed since the writable vdisk was created;
searching each field of the writable vdisk for a hole; and
referencing each hole in the writable vdisk to point to the data block referenced by the corresponding backing store indirect block to update the writable vdisk to reference both the data which is unchanged since the writable vdisk was created and the data which has been changed since the writable vdisk was created.

Cameron discloses a system and method that adds new data to a snapshot, and preserves the old data using a COW to copy the old data to a ROSS. (See Cameron, Col. 7, Lines 13-59). Specifically, Cameron first receives a new write request to a data block. (See Cameron, Col. 7, Lines 21 – 24). Then, Cameron “traverses the address tables of the ROSS” to determine if the data block is in the ROSS, and if it is not, this new write request is deemed to be the first write to the data block. If the new write request is the first write request, Cameron invokes a COW operation that copies the contents of the data blocks from the RWSS (or an earlier parent or the base) to the ROSS, and writes the new data to the RWSS. (See Cameron, Col. 7, Lines 36-39). If the new write request is not the first write request, Cameron simply writes the new data to the RWSS. (See Cameron, Col. 7, Lines 34 – 35).

A. Cameron's RWSS 202 'holes' are NOT analogous to Applicant's claimed 'holes'.

Applicant respectfully submits that Cameron fails to teach or suggest Applicant's claimed novel where each hole instructs the storage system to examine a corresponding virtual block number pointers in a backing store.

First, Applicant respectfully notes that the amendment to the claims is fully supported by Applicant's Specification. Specifically, Applicant's Specification states:

"Briefly, the sparse vdisk in the active file system is "translucent", i.e., initially the vdisk has a size equal to the size of the snapshot file because there is no data other than the snapshot file data. Since there is no data in the initial instance of the vdisk, the vdisk is completely filled with 'holes.'" (See Applicant's Specification, Page 23, Lines 3 – 6).

Further, Applicant Specification states:

"In the illustrative embodiment, a special vdisk loading function 1040 of the file system "walks through" the level 1 buffers (indirect blocks) of the writable vdisk, searching for invalid VBN pointers. Note that a valid VBN pointer has a non-zero value that directly references a data block, whereas an invalid VBN pointer has a zero value that represents a hole. Such a hole instructs the file system to examine the value of the VBN pointer in the corresponding level 1 buffer of the backing store." (See Applicant's Specification, Page 25, Lines 15 – 20).

Therefore, Applicant's claim recites a hole that instructs the file system to examine a corresponding VBN in the backing store and DOES NOT represent data, is fully supported by Applicant's Specification.

In short, Applicant respectfully submits that Applicant's holes, as claimed, do not represent data but instead instruct Applicant's system to examine the backing store. Quite differently, the 'holes' in Cameron's RWSS reference data that has not been modified.

Specifically, Applicant respectfully submits that the RWSS in Cameron is a file full of snapshot data. This is fully supported in Cameron at Col. 7, Lines 36-42 which states,

"the storage management program invokes a COW operation to copy the contents of the data blocks to the ROSS in the following manner. The storage management program first tries to read the data block from the RWSS....Once the blocks have been read, the storage management program writes the data blocks to the ROSS."

The cited text above clearly states that the data is copied from the RWSS to the ROSS, and thus there are no holes, as is claimed by Applicant. If the RWSS was full of 'holes' as suggested by the Examiner, the copy from the RWSS to the ROSS could not occur, because there would be no data, and thus the copy operation would be meaningless.

Further, Applicant respectfully notes that in the Examiner's "Response to Arguments" of the Office Action dated June 27, 2008, the Examiner acknowledges that RWSS

is NOT filled with holes as is currently claimed by Applicant, but instead that the RWSS contains data. Specifically, the Examiner states:

“for a distinct period of time between when RWSS 202 is created and when RWSS 202 receives its first right, *RWSS is completely filled with all ‘holes’* (i.e. data which has not been changed since RWSS was created) because none of the data on RWSS has been modified (i.e. dirtied) by a write operation.” (See Office Action, Page 23, Paragraph 42).

Therefore, as the Examiner asserts in the Office Action, the ‘holes’ disclosed in Cameron reference data, while Applicant’s claimed holes **do not** reference data, but rather instruct the Applicant’s system to examine corresponding virtual block number pointers in a backing store.

Accordingly, Applicant respectfully submits that Cameron is legally insufficient to render the presently claimed invention unpatentable under 35 USC §102 because of the absence in Cameron of Applicant’s claimed novel *where each hole instructs the storage system to examine a corresponding virtual block number pointers in a backing store.*

B. Cameron does not search a vdisk for holes.

Further, Applicant respectfully submits that Cameron fails to teach or suggest Applicant’s claimed novel *searching each field of the writable vdisk for a hole.*

Specifically, as illustrated above, Cameron’s ‘holes’ are different than Applicant’s claimed holes. Applicant respectfully submits that because Applicant’s claimed ‘holes’ do not reference data, while Cameron’s ‘holes’ do represent data, Cameron fails to search a writable vdisk for a hole, as is claimed by Applicant. Moreover, Applicant respectfully

submits that Cameron is completely silent with respect to Applicant's novel claim as highlighted above.

In his "Response to Arguments", the Examiner asserted:

"between the time RWSS 202 is created and ROSS 204-j is created, there are no writes to RWSS 202, therefore, all the blocks in RWSS 202 are 'holes.' Thus, at the point in time when ROSS 204-j is created from RWSS 2020, in effect all the 'holes' (i.e. blocks) in RWSS 202 are 'searched' in order for each hole/block in RWSS to be properly referenced to point to the corresponding block referenced by ROSS 204-j." (See Office Action, Page 24, Paragraph 43).

Thus, the Examiner's comments above acknowledge that the 'holes' in RWSS are data blocks. Therefore, because Applicant's claimed 'holes' are different than the 'holes' disclosed in Cameron, Applicant respectfully submits that Cameron fails to teach or suggest Applicant's claimed novel searching each field of the writable vdisk for a hole.

Moreover, Applicant respectfully submits that the Cameron patent is completely silent with respect to Applicant's claimed searching each field of the writable vdisk for a hole.

The Examiner, citing Col. 7, Lines 18 – 24 of Cameron, urged:

"the mere creation of ROSS 204-j from RWSS 202 [in the case where this occurs before there have been any writes to RWSS 202] inherently requires Cameron to perform both the 'searching' and 'referencing'." (See Office Action, Page 4, Paragraph 4).

Applicant respectfully disagrees. Specifically, Col. 7, Lines 18 – 24 of Cameron states:

"In action 604, the storage management program creates a ROSS that descends from RWSS (e.g., ROSS 204-j descending from RWSS 202 in Fig. 1).

In action 606, the storage management program waits and then receives the block address of the data block to be written in the RWSS for the user (e.g., address 0x999888777 of RWSS 202 in FIG. 1).” (See Cameron, Col. 7, Lines 18 – 24).

Applicant respectfully submits that the above text of Cameron, that the Examiner cites, is completely silent with respect to searching for holes as is claimed by Applicant. Further, as previously noted, since Applicant’s claimed ‘holes’ are different than Cameron’s holes, Cameron fails to teach or suggest Applicant’s claimed novel “searching each field of the writable vdisk for a hole.”

Accordingly, Applicant respectfully submits that Cameron is legally insufficient. Cameron is legally insufficient to render the presently claimed invention unpatentable under 35 USC §102 because of the absence in Cameron of Applicant’s claimed novel “searching each field of the writable vdisk for a hole.”

Claim Rejection – 35 USC §103

At paragraphs 6 –37 of the Office Action claims 1 – 15, 19, 20, 24 – 30, and 32 – 38 were rejected under 35 USC §103(a) as being anticipated by Cameron in view of Haskin et al., U.S. Publication No. 2003/0158863, Published August 21, 2003 (hereinafter “Haskin”).

Applicant’s claimed invention, as set forth by independent claim 1, comprises in part:

1. A method for operating a data storage system, comprising:
creating a writable virtual disk (vdisk) at a selected time, the writable vdisk referencing changes in data stored in the data storage system after the writable vdisk was created,

maintaining a backing store, the backing store referencing data stored in the data storage system which has not been changed since the writable vdisk was created;

loading blocks of the writable vdisk from a disk into a memory, the loaded blocks including a writable vdisk indirect block having a plurality of fields, each field storing a valid pointer to a data block or an invalid pointer representing a particular hole of a plurality of holes, where each hole instructs the data storage system to examine a corresponding virtual block number pointers in the backing store;

loading blocks of the backing store from a disk into the memory, the loaded blocks including a backing store indirect block having a plurality of fields, each backing store indirect block field corresponding to a field of the writable vdisk indirect block, one or more backing store indirect block fields having a pointer to a data block;

searching each field of the writable vdisk indirect block for a hole; and

replacing each field having a hole in the writable vdisk indirect block with a new pointer to the data block referenced by the corresponding backing store indirect block field to update the writable vdisk to reference both the data which is unchanged since the writable vdisk was created and the data which has been changed since the writable vdisk was created.

Haskin discloses a system and for providing a file system snapshot with a ditto address feature. (See Haskin, Par. [0012]). Figure 2B of Haskin discloses a block diagram depicting an inode and related data blocks. (see Haskin, Par. [0018]).

Applicant respectfully submits that Cameron and Haskin, either alone or in combination, fail to teach or suggest Applicant's claimed novel where each hole instructs the data storage system to examine a corresponding virtual block number pointers in the backing store AND searching each field of the writable vdisk indirect block for a hole.

First, Applicant respectfully notes that the Examiner **never** asserts that Haskin teaches either of the above highlighted portions of Applicant novel claim. Specifically, in reference to the 'holes' as is claimed by Applicant, the Examiner asserts that Cameron teaches this feature of Applicant's claim.

Applicant respectfully submits that for the same reasons asserted under the 102 analysis, Cameron fails to teach or suggest Applicant's novel claim as highlighted above. Specifically, Applicant respectfully submits that Applicant's holes **do not** reference data, but instead instruct the system to examine corresponding VBN points of a backing store, while Cameron's 'holes', reference data blocks. Accordingly, Applicant's claimed 'holes' and Cameron's 'hole's, as categorized by the Examiner, are **NOT** equivalent.

Further, Applicant respectfully submits that Haskin also fails to teach or suggest Applicant claim as highlighted above and thus fails to cure the deficiencies of Cameron.

Accordingly, Applicant respectfully submits that Cameron and Haskin, either alone or in combination, are legally insufficient to render the presently claimed invention unpatentable under 35 USC §103 because of the Absence in Cameron and Haskin of Applicant's claimed novel where each hole instructs the data storage system to examine a corresponding virtual block number pointers in the backing store AND searching each field of the writable vdisk indirect block for a hole.

At paragraphs 6 and 38 – 40 of the Office Action claims 40 – 42 were rejected under 35 USC §103(a) as being anticipated by Cameron in view of Armangau et al., U.S. Patent No. 6,792,518, issued September 14, 2004 (hereinafter "Armangau").

Applicant's claimed invention, as set forth by independent claim 40, comprises in part:

40. A method for operating a data storage system, comprising:
creating a writable virtual disk (vdisk) at a selected time, the writable vdisk referencing changes in data stored in the data storage system after the writable vdisk was created, the writable vdisk having a plurality

of holes where each hole instructs the data storage system to examine a corresponding virtual block number pointers in a backing store;

maintaining the backing store, the backing store referencing the data stored in the data storage system which has not been changed since the writable vdisk was created;

searching, by a background task process, each field of the writable vdisk for a hole; and

referencing each hole in the writable vdisk to point to the data block referenced by the corresponding backing store indirect block to update the writable vdisk to reference both the data which is unchanged since the writable vdisk was created and the data which has been changed since the writable vdisk was created.

Armangau discloses a system and method for providing access to a production dataset and at least one snapshot dataset. (See Armangau, Col. 2, Lines 16 – 18). Further, Armangau discloses a “Background routine for copying the save volume for the snapshot (N) to the clone volume.” (See Armangau, Col. 14, Lines 15 – 16).

Applicant respectfully submits that Cameron and Armangau, either alone or in combination, fail to teach or suggest Applicant’s claimed novel holes where each hole instructs the data storage system to examine a corresponding virtual block number pointers in a backing store AND searching, by a background task process, each field of the writable vdisk for a hole.

First, Applicant notes that the Examiner **never** asserts that Armangau teaches Applicant’s novel claim as highlighted above. (see Office Action, Page 19). In fact, Applicant respectfully submits that the Armangau is completely silent with respect to these features of Applicant’s claim.

Instead, the Examiner asserts that Cameron teaches Applicant’s novel claim as emphasized above. Applicant respectfully disagrees and submits that for the same rea-

sons asserted under the 102 analysis, Cameron's 'holes' are not equivalent to Applicant's claimed holes. Specifically, Cameron's 'holes', as categorized by the Examiner, reference data, while the holes in Applicant's novel claim **do not** reference data but rather instruct the system to examine corresponding VBN pointers in a backing store. Further, because Cameron's 'hole's and Applicant's 'holes' are different, Cameron also fails to **search a writable vdisk for a hole.**

Accordingly, Applicant respectfully submits that Cameron and Armangau, either alone or in combination, are insufficient to render the presently claimed invention unpatentable under 35 USC §103 because of the Absence in Cameron and Armangau of Applicant's claimed novel *holes where each hole instructs the data storage system to examine a corresponding virtual block number pointers in a backing store AND searching, by a background task process, each field of the writable vdisk for a hole.*

All independent claims are believed to be in condition for allowance.

All dependent claims are dependent from independent claims which are believed to be in condition for allowance. Accordingly, all dependent claims are believed to be in condition for allowance.

Favorable action is respectfully solicited.

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Please charge any additional fee occasioned by this paper to our Deposit Account
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